

Summary

Antimony is a metal that occurs naturally in the earth's crust. The most important commercial compound derived from antimony is antimony trioxide (commonly known as ATO, chemical formula Sb_2O_3). ATO is used in a wide variety of industrial applications, principally as a "synergist" with flame retardant chemicals and as a catalyst in the manufacture of polyester (PET). The total global consumption of ATO in 2010 was approximately 120.000 tons.

Applications

ATO is the material of choice in several applications due to its unique properties.

1. Synergist with flame retardants

Over the last few decades, fire safety in our homes and public places have improved greatly, thanks mainly to international standardization efforts in electrical and electronic equipment and transportation. These standards specify that inherently flammable materials should be made fire safe to a high degree, which often requires the use of flame retardant chemicals. ATO greatly enhances the effectiveness of flame retardants, when used as a synergist in combination with halogenated flame retardants in plastics, paints, adhesives, sealants, rubber and textile back coatings.



ATO is so used in many appliances within our homes and offices; TVs, computers, household appliances, industrial electrical installations, optical cables, mains adapters and portable electronics and to fire safe plastic casings, resin circuit boards, switches and components. It is incorporated into upholstered furniture, insulation and decorative foams and building materials, and is used in clothing where fire is a risk, for example, children's nightwear and hospital linen as well as in technical fire-resistant textiles for professional uses. In transport vehicles its role as a flame retardant in seats, cables and plastic structures facilitates more time to escape should a fire occur. Thousands of lives have been saved and tens of thousands of disfiguring burn injuries have been avoided by the use of antimony trioxide as a flame retardant synergist (Statistics: UK Department of Trade and Industry: Effectiveness of the Furniture and Furnishings (Fire Safety) Regulations 1988. London, June 2000, URN 00/783).

2. PET



ATO is the major catalyst for the production of PET bottles used in the packaging of mineral water and soft drinks. PET is one of the best materials for plastic bottles, with a history of safe use by millions of consumers every day.

ATO's safety in the production of PET bottles has been confirmed by the World Health Organisation (2003), the European Food Safety Authority (2004), the EU Risk Assessment (2008), the OECD review (2008) and the Canadian Risk Assessment (2010). It is safe to state that the use of ATO as a catalyst in PET bottles does not impact the safety of the beverages under normal conditions and use.

3. Other uses

- As a clarifying aid in certain **glasses**, additive in semi-conductors,
- As a coating used on certain grades of titanium dioxide **pigments**,
- As a component in the manufacturing of **complex inorganic colored rutile pigments** and
- As an opacifier in **cast iron bath** and **sinking enameling**.

Health and Environment Compatibility

ATO has been extensively studied as to its compatibility with the environment and human health. The [EU Risk Assessment Report \(RAR\)¹ on diantimony trioxide](#), carried out under the Existing Substances Regulation 793/93, was finalized in mid 2008. ATO's safety was confirmed by the [OECD review](#)²(2008) and by the [Canadian Risk Assessment \(2010\)³](#). The final outcome of the EU Risk Assessment is as follows:

Environmental effects:

ATO required no environmental hazard classification. It is not harmful to aquatic organisms. Based on the exposure scenarios reported in the REACH dossier ATO does not pose a risk to the environment at continental, regional or at local levels.

Human Health:

ATO is not acutely toxic, nor a sensitizer, eye or respiratory tract irritant. It is not considered poisonous via oral ingestion or inhalation. ATO is not reprotoxic and not genotoxic in vivo. There is no evidence that the industrial manufacture and use of antimony trioxide cause antimony to accumulate in the food chain. No risks were identified to consumers or to the general public when indirectly exposed, via the environment, via the food chain or via mother's milk, drinking water or outdoor air. ATO is not classified as a SVHC (Substance of Very High Concern) under REACH. Further details can be found on the i2a website.

Some concerns were identified for workers in terms of pulmonary toxicity. ATO is classified in the EU with the risk phrase R40 – limited evidence of a carcinogenic effect. This classification comes from a potential hazard that has been identified in relation to the high inhalation exposure of laboratory animals (rats) to the substance: more than 10 times the occupational threshold limit value of 0.5 mg/m³, which is the limit value for people exposed to ATO at their workplace for 8 hours per day, 5 days per week. Such high exposures would never occur in practice. Further, the mechanism of this carcinogenic effect seen in rats is linked to an overloading of the lungs with fine inert particles considered specific to rats, and so with questionable relevance for humans. ATO is not expected to cause cancer via ingestion, for the following reasons: (i) it has been shown to be of very poor oral bioavailability (<1%); (ii) it was void of any systemic toxicity in oral 90d toxicity studies in the rat at doses exceeding 1,000 mg/kg b/w; (iii) in inhalation cancer studies involving exposures up to approx. 50 mg/m³, there were no indications of systemic carcinogenicity; (iv) ATO possesses neither mutagenic nor clastogenic activity.

To further minimise dust formation, hygienic grades – such as damped or wetted paste, granular and polymer bound masterbatch grades - are becoming common practice.

The Classification and Labeling of ATO is available on the i2a website, <http://www.antimony.be/CLP/CLP-antimony-trioxide.htm>.

Regulatory Status – REACH compliance

Scientific tests results from the EU RAR are incorporated into the REACH registration dossier of ATO. ATO was registered in September 2010 and is compliant with the new EU chemicals legislation, REACH.

Trading Status

ATO can be traded without restriction in the EU, subject to it meeting the purity levels specified by relevant legislation for lead and arsenic. Antimony oxide is excluded from some ecolabels (some Blue Angel and EU Flower ecolabels) because of the R40 phrase. Such ecolabel criteria are based on hazard and not risk mentioned above. Consumers handling plastics containing ATO or eating food stored in these plastics are not exposed by inhalation, since ATO is encapsulated in the polymeric matrix. No exposure = no risk as was recently confirmed by SCHERⁱ in their opinion on the safe use of ATO in toys. We as i2a are pursuing this ecolabel issue with the EU Authorities.

Antimony oxide requires declaration in some of the Materials Declaration Guides in the automotive and electronics and electrical sector, by certain OEMs and by the Global Automotive Declarable Substance List (GADSL).

References:

¹ECB, 2008. European Union Risk Assessment Report, diantimony trioxide

²OECD (2008) SIDS Initial Assessment Profile for diantimony trioxide. SIAM 27, 14-16 October 2008. <http://webnet.oecd.org/hpv/UI/handler.axd?id=13e93c97-6605-4eac-961f-8af23cc6ad32>

³Environment Canada (2010). Draft screening assessment for the challenge. Antimony oxide. Environment Canada Health Canada, March 2010. http://www.ec.gc.ca/substances/ese/eng/challenge/batch9/batch9_1309-64-4_en.pdf

ⁱ Scientific Committee on Health and Environmental Risks